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A PIPELINE INSPECTION ROBOT

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Abstract

Robotics is one of the most rapidly rising technical fields today. Robots are designed to replace humans in labor-intensive or dangerous activities, as well as to operate in inaccessible settings. Robots are being recruited more frequently than ever before, and they aren't just for heavy manufacturing. Robotic inspection is used in a wide range of sectors. One use is for monitoring the inside of pipelines and channels, as well as identifying and repairing faults within them. A cellular robotic may also do a computerized examination of a pipe's inside floor. The goal of the project is to extend an inspection.The mechanism employed consists of a critical rod onto which a translational detail is mounted, which is then coupled to three linkage and wheel frames. The wheels of DC automobiles are connected to provide the necessary propulsion. The technology allows self-contained robots to be hired for in-pipe housing in small pipe diameters. An electrical circuit made up of three relay switches controls the complete circuitry of DC automobiles, digital digicams, and translational detail. The digital digicam is mounted on the top of the assembly and may be adjusted to provide a wide field of vision with within the pipe. Fractures, buckles, corrosion, pitting, and other flaws can be detected by the robots. has been a huge success for a fraction of the cost of the initial robotic shopping price

***Index Terms* :**Robot, Pipes defects, Electronics control systems, Digital video,corrosion,Links,Wheel Frames

I.INTRODUCTION

Pipeline systems gradually degrade over time. Corrosion accelerates with time, and long-term corrosion raises the risk of collapse (fatigue cracking). Regularly monitoring only the "junk" section of pipes leads to a pipeline system with uncertain integrity. The degree of trust in honesty will fall below acceptable limits. Inspection of previously uninspected pipeline portions becomes necessary. This project includes details on "robotic inspection technology." Pipelines have been shown to be the safest method of transporting and distributing gases and liquids.Direct pipe wall contact/access is the only way to get sufficiently trustworthy and precise inspection findings. We'll have to go inside if that's not possible from the outside. Because it is usually impractical to adapt pipeline systems for In-Line Inspection, PIPE INSPECTION ROBOT is working on developing ROBOTIC inspection services for currently inaccessible pipeline systems Robotics is one of today's most rapidly rising engineering topics. Robots are made to take over labor-intensive or risky jobs, as well as to operate in inaccessible environments. Robotics are now more widely employed than ever before, and they are no longer limited to heavy manufacturing enterprises. Pipe inspection might be useful for increasing industrial plant security and efficiency

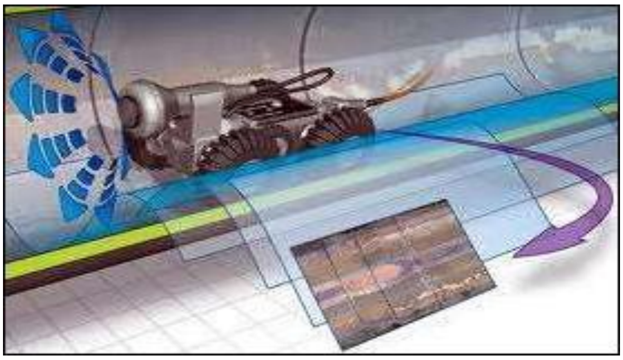

Figure 1.Pipe inspection robot

II.METHODOLOGY

2.1 Problem Statement

The motor's materials should have a high magnetic susceptibility and be good conductors of electricity. Copper and other metals are used. However, due of its desirable properties, aluminium was chosen as the material for the connections and central body. Aluminum is lightweight and strong, making it suitable for a wide range of applications.Engineering buildings employ aluminium alloys with a variety of characteristics. Aluminum alloys vary greatly in strength and endurance, not only due to the components of the alloy, but also due to heat treatments and manufacturing processes.The heat sensitivity of aluminium alloys is another essential feature.

2.2 Mechanism

As shown, the mechanism in question is a four-bar mechanism with three revolute joints and one prismatic junction.

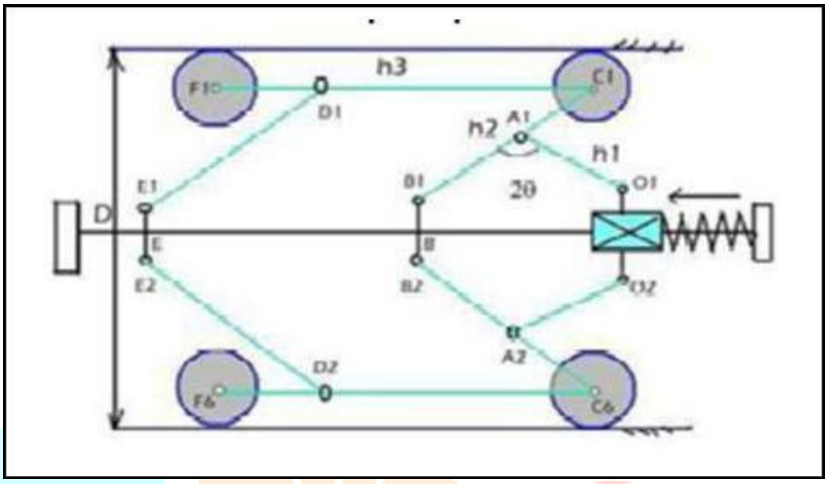

Figure 2. Mechanism

$H = 2r + 2d + 2h2 \times \cos\theta$,
Where
h1 = 30 mm.
h2 = 85 mm.
h3 = 105 mm (h1 =OA, h2 = BC = D)
$H=2\times36+2\times28+2\times85\times\cos 45$
H=248.20mm
Where D-Diameter of the pipe in mm, d-Distance between EE' in mm.h1, h2, h3 are the length of the links in mm. r-Radius of the wheel, H=Height of robot outside the pipe.
For uniform Diameter,
Assume $D = 2r+2d+2h2\cos\theta$
$D=2\times36+2\times28+2\times85\times\cos 50$
D=237.27mm

2.3 Design of various elements of PIR

Helical spring
Inner diameter – 18 mm
Outer dia – 20 mm
Pitch – 5 mm
Length of the spring – 60 mm
Material – Stainless steel

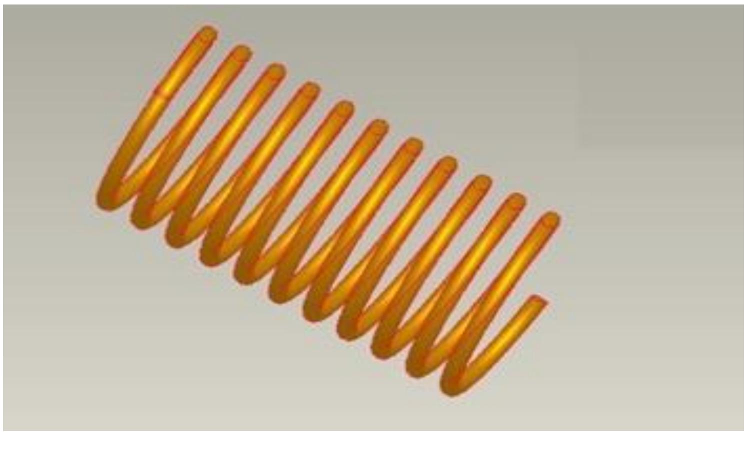

Figure 3 Helical Spring

Translational Element
Inner diameter – 18 mm
Outer diameter – 23 mm
Length of the element – 25 mm
Material – Mild steel

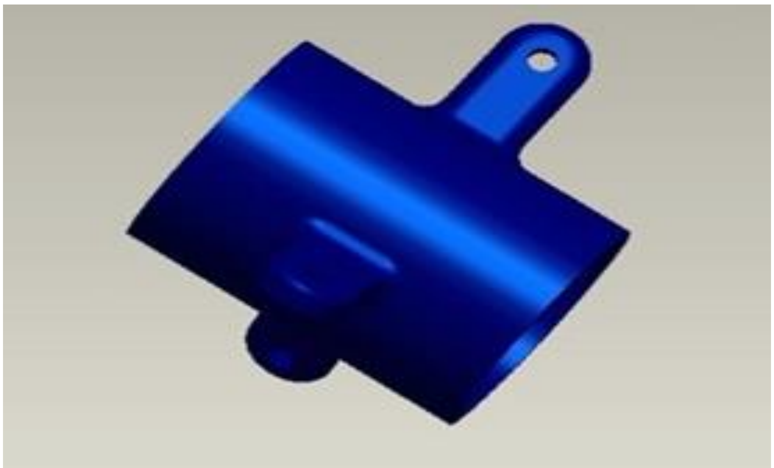

Figure 4 .Translational Element

Distance between the Extreme links
Drilled Holes
Link 1 – 30 mm
Link2 – 85 mm
Link3 – 105 mm
Thickness – 3 mm
Drilled holes – 12 and 6 mm
Material – Acrylic

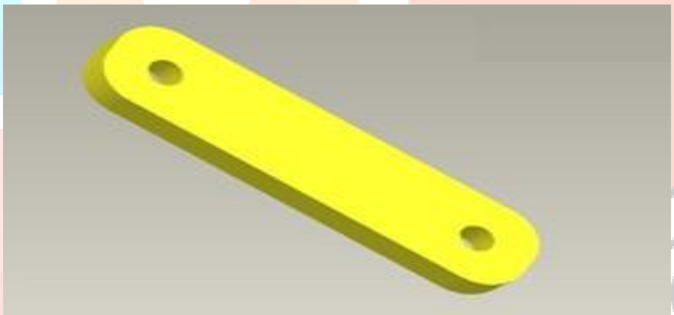

Figure.5 Extreme link

Central Element
Hollow
Inner dia – 15 mm
Outer dia – 20 mm
Length – 220 mm
Material – Mild steel

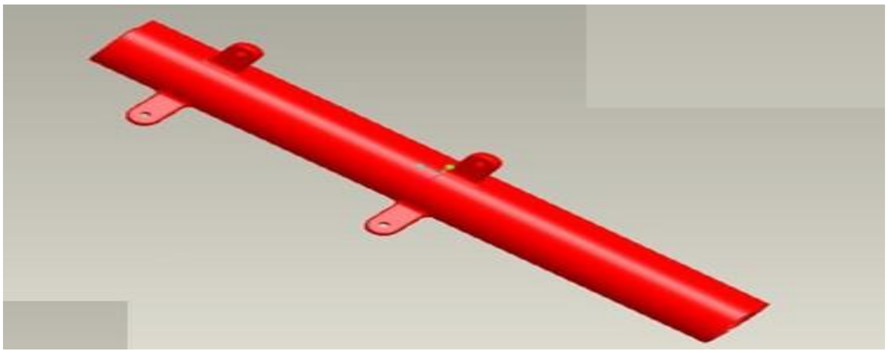

Figure 6. Central Element

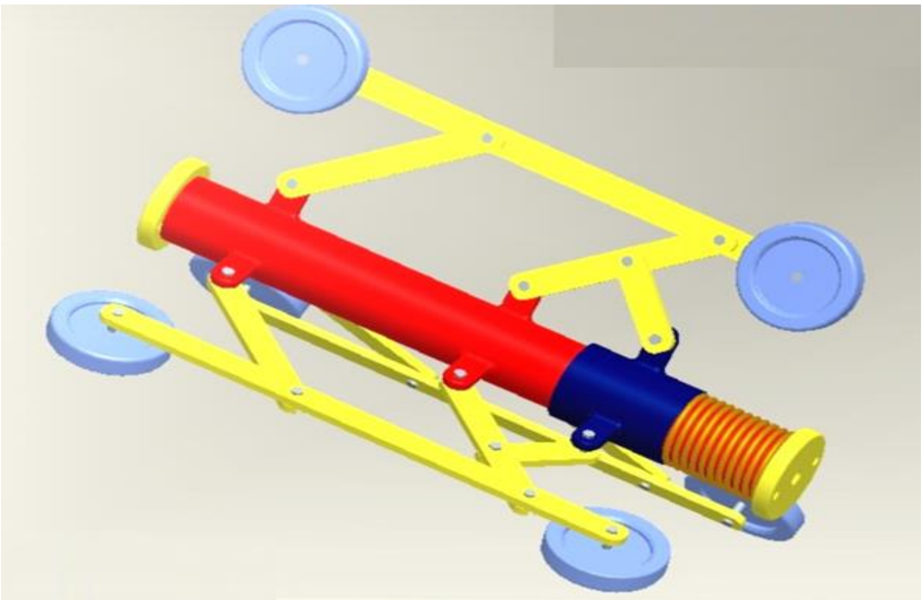

Figure.7 Final design

III.RESULTS AND DISCUSSION

Table 1 .Bill of Material& Cost of Estimation

SR.	NAME OF MATERIAL	QUANTITY
1.	M. S. round bar	02
2.	Acrylic sheet 1*2 feet	02
3.	Screw	40
4.	Nut	40
5.	M.S. plate	01
6	Sheet metal (pipe) 8 feet	01
7.	D.C. Motor	12
8.	Bo Motor	02
9.	CCD Camera	01
10.	Extension cable of camera	01
11.	Remote	01
12.	Robot wheel	12
13.	10 core wire 15 feet	01
14.	Spring	02
15.	Adapter (12V)	01
16.	Supply wire 10 feet	01
17.	Washer	40

Table.2 Cost of Estimation

SR.	NAME OF MATERIAL	QUANTITY	AMOUNT
1.	M. S. round bar 12.7mm dia. ×3mm thick	2	60
2.	Acrylic sheet 3mm thick	2	160
3.	Screw 12.7mm	40	20
4.	Nut	40	20
5.	M.S. plate	1	20
6	Sheet metal (pipe) 8 feet×9‖	1	1500
7.	D.C. Motor 12v/10 rpm	12	2220
8.	Bo Motor 3v/60 rpm	2	325
9.	CCD Camera 12 mega pixel	1	650
10.	Extension cable of camera 10m	1	150
11.	Remote 3 switch	1	90
12.	Robot wheel	12	480
13.	10 core wire 15 feet	1	150
14.	Spring	2	60
15.	Adapter (12V)	1	450
16.	Supply wire 10 feet	1	30
17	Washer	40	20
	TOTAL		6435 Rs.

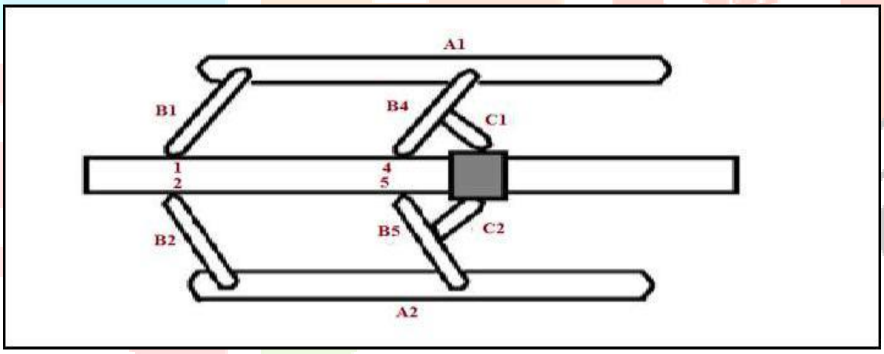

Figure.8 Construction of links

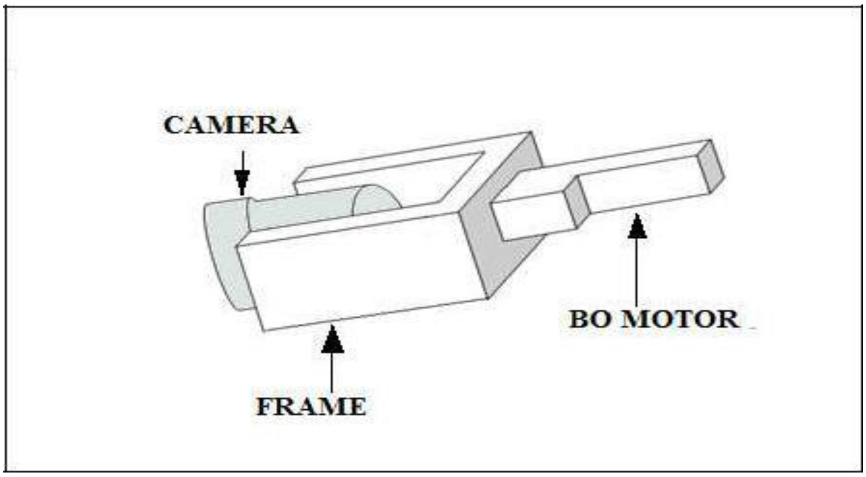

Figure.9 Construction of camera head

Figure.10 PIR moving inside the pipe

Figure.11 Picture showing working of PIR inside the pipe

IV.CONCLUSION

Robots play an important role in pipe network maintenance and repair. Some were designed to do certain tasks for pipes with fixed diameters, while others may vary the structural function of the pipe being checked. This proposal proposes within pipe modular robotic systems. A significant design goal is for these robotic devices to adjust to the inner diameters of the pipes. The prototype allows for the use of a mini-camera or other devices for viewing in-pipe inspections or detecting faults that occur inside pipes (measuring systems with laser, sensors etc).The key advantage is that it may be used in circumstances of pipe diameter modification with a simple mechanism. We developed a pipe inspection robot capable of inspecting pipes with diameters ranging from 203mm to 254mm. An real prototype was built to test the practicality of this robot for in-house pipeline inspection. The many types of inspection duties are rather varied. A modular design was investigated in order to make it easily adaptable to new environments with few changes.The existence of obstacles in pipelines is a serious concern. The proposed technique addresses the issue by employing spring actuation and increasing the device's flexibility. The robot will travel both horizontal and vertical pipes. A variety of pipe inspection small robot modules were demonstrated. Many of the design goals for the Pipe inspection robot have been completely realized.

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